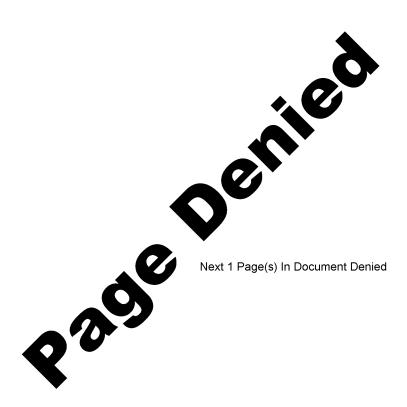
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ON STRUCTURE DEFECTS IN SILICON SINGLE CRYSTALS INTRODUCED FAST ELECTRON AND NEUTRON IRRADIATION

V.S. Vavilov (Abstract)

Silicon single crystals are of interest as an object for the investigation both of the primary process of atoms displacement and the introduction of Frenkel pairs by irradiation, and also of the subsequent interaction of vacancies and interstitial atoms with chemical impurities and the energy levels of the resulting local imperfection centers.

The investigation of the photoconductivity in the impurity spectral range at low temperatures, combined with Hall effect measurements gave us a possibility of a further understanding of energy levels spectrum and other properties of centers introduced into silicon by electron and neutron irradiation and having complex nature as compared with partners of a Frenkel pair. The analysis of the photoconductivity spectra makes it possible to resolve the structure of the deep energy levels systems when other methods, for instance Hall effect or recombination rate measurements only indicate the presence of deep levels. At present, the energy levels system resulting from radiation induced imperfections in silicon includes the data of the table 1.

According to our results the photoconductivity spectra of identical silicon samples irradiated by electrons and neutrons practically coincide, which indicates the absence of group effects playing probably an important part in case of germanium.

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Experiments with crystals bombarded by electrons at 100° K show that the final discrete photoconductivity spectrum is a result of the defects or impurities thermally activated migration. At the initial stage after the low temperature bombardment no structure in the photoconductivity spectrum is visible.

The parallel investigation of the annealing of photoconductivity and Hall effect in irradiated silicon gave us a possibility to correlate the optival and thermal ionisation energies for some of the energy levels of the defects.

The irradiation of silicon samples containing lithium and copper shows that the interaction of the defects with these impurities strongly affects the stability of defects and the introduction rates of energy levels. However, the system of radiation induced energy levels remains practically unchanged.

The results were obtained in collaboration with A.F.Plotnikov, G.N.Galkin, V.M.Malovetskaja and I.V.Smirnova.

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Table 1

Energy level	E 0,03er	E _c -0,16 ev	Ec - 0,21ev	E _c - 0,4ev	Middle of forbidden		E,+0,38ev		0,2 77		
The nature of defect or complex	Frenkel pair?	Association of vaccoursy and oxygen atom	determinal	Association of vaccincy with dona impority atom	Not dotumined	Nat daterminad	Not datermined	Not dotermined	interstitial with oxygen atm	pair?	
Experimental method	Capture of electrons	Hall Effect Person that tim zate Photo on- duct wity	Infrared absorbtion		Recombine tion rate	Photo- conducti- vity	Photo- conducti- vity	Photo- onducti- vity	Hall Effect Recombi- nation 2 ate Photo- conducti- vity	of holes	
Reforence	1	3, 4, 5, 6, 7, 8	2	1,6,7	3	7	7	7	1, 2, 3	1	
1. 2. 3. 4. 5. 6. 7. 8	H. Fan, g. Wer g. N. g g. Bon g. Was	A. Rumo theim, F alkin, I thins T	hys Ker V.s Ryto Sppl. I Corlett S. N. Lotk	hy : 30,	(1957) 1 (1957) 1 (1956) (195 (19 (195) 4 (195) 19	solid stu ess) pept. Phy how, Ph	(1938) te Phys.)				s ford (1962) p. 31

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